



Relationship between fastening properties and load deflection response of wood shear walls

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1. Introduction

A shear wall is a structural system used to resist lateral forces, such as wind and earthquakes, that act on a structure. Wood shear walls are composed of frames, sheathing panels, and fasteners.

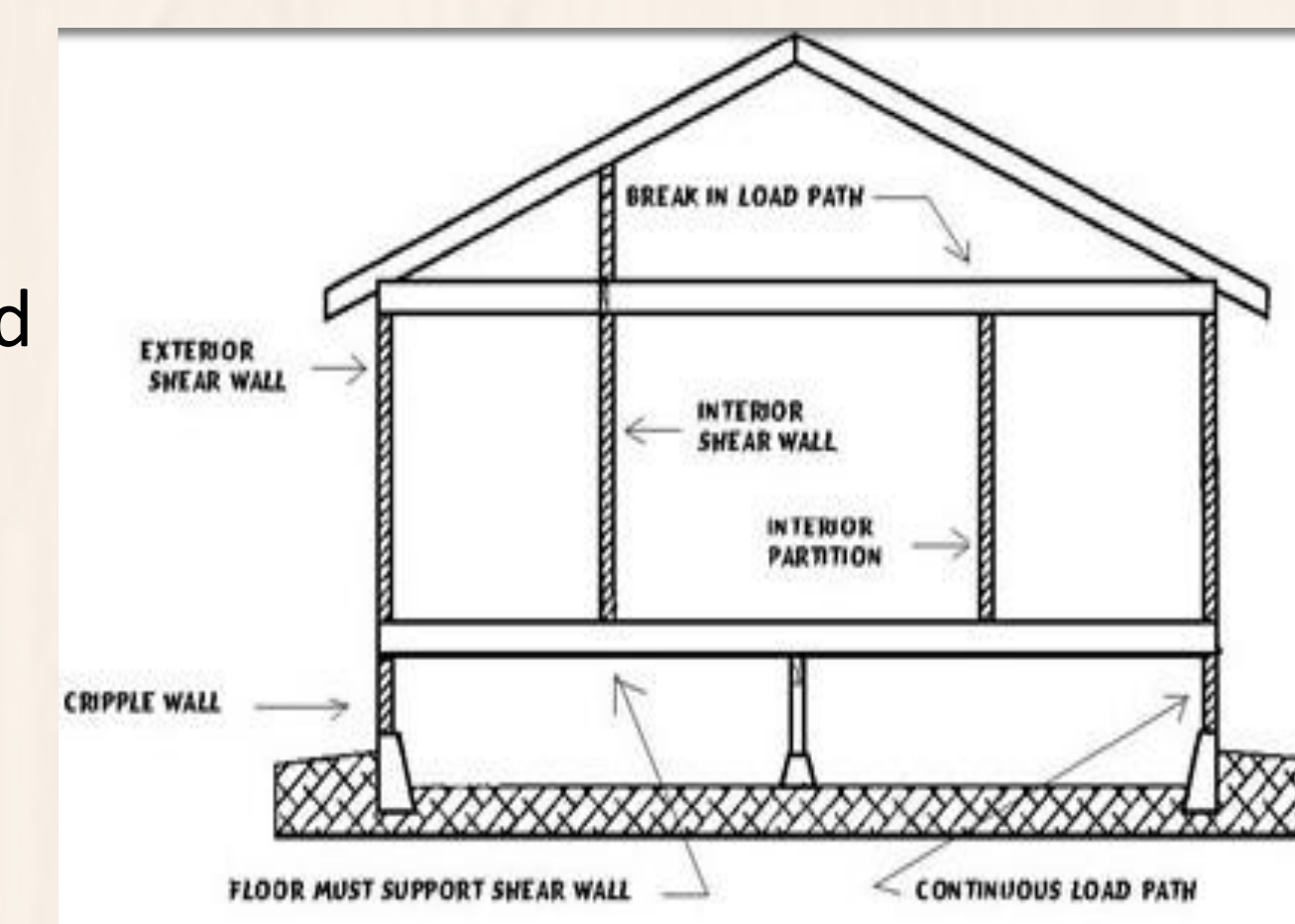
Gypsum wallboard (GWB), oriented strand board (OSB) and plywood can be used as sheathing in a typical shear wall construction.

Inadequate shear wall construction has been responsible for enormous amounts of damage in past and recent earthquake events.

At present, different sheathing materials have proven to provide diverse results with respect to ductility, nail-holding, protection, etc.

With a focus on GWB, this sheathing material is believed to be brittle. Therefore, it was assumed that a shear wall constructed with GWB would easily fail.

The Wood Design Manual has not yet included a relationship for GWB deflection under an applied force. In fact, there exists far more design potential that GWB possesses. By studying the responses of joint level specimens fastened with nails and screws under an applied force, this research will prove that GWB provides some ductility to the system.



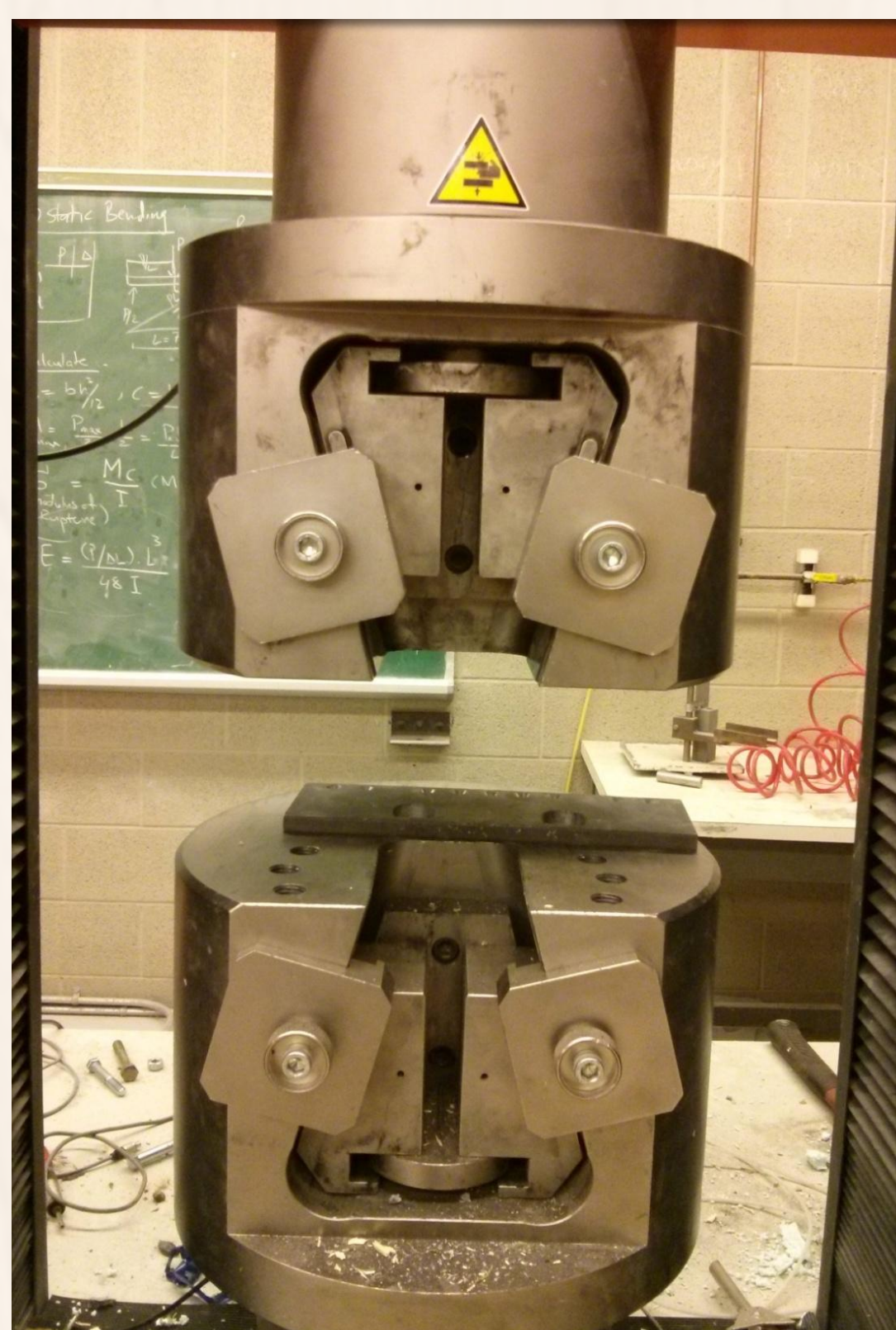
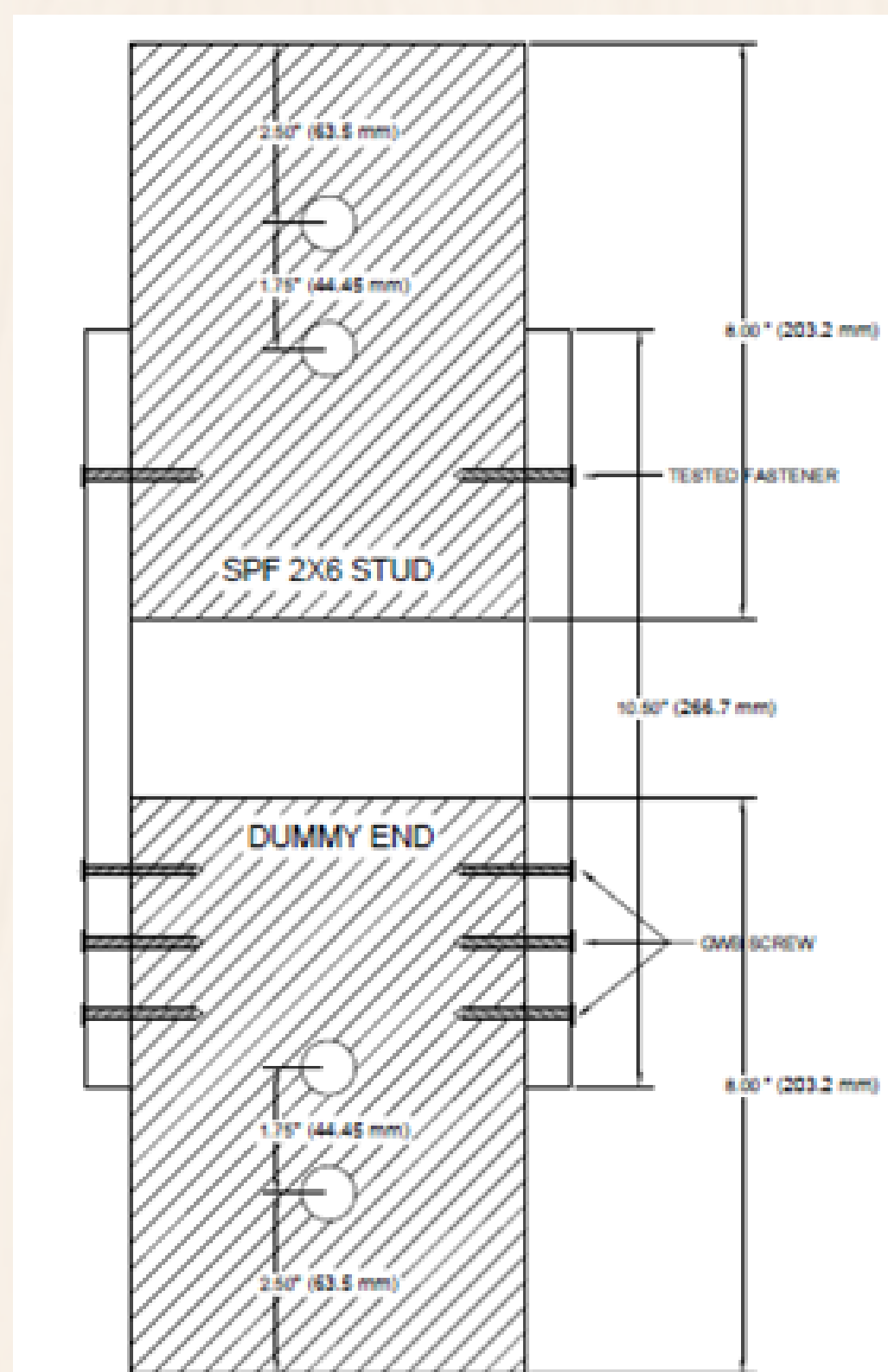
2. Methodology

1) Selecting the GWB Type Requirements:

- Type -X gypsum (fire resistant)
- Regular gypsum (housing and small buildings)

2) Selecting the Fasteners and Framing Lumber Requirements:

- Fasteners based on CSA-O86
- Spruce-Pine-Fir (S-P-F) Lumber (high availability)



3. Results

The results obtained did prove that gypsum provides ductility to the system. Each test was repeated 10 times. Then, the average of the positive and negative envelop curves of each test was compared to the average of all ten tests.

Figure 1: Typical Fastener Joint Specimen Test Result

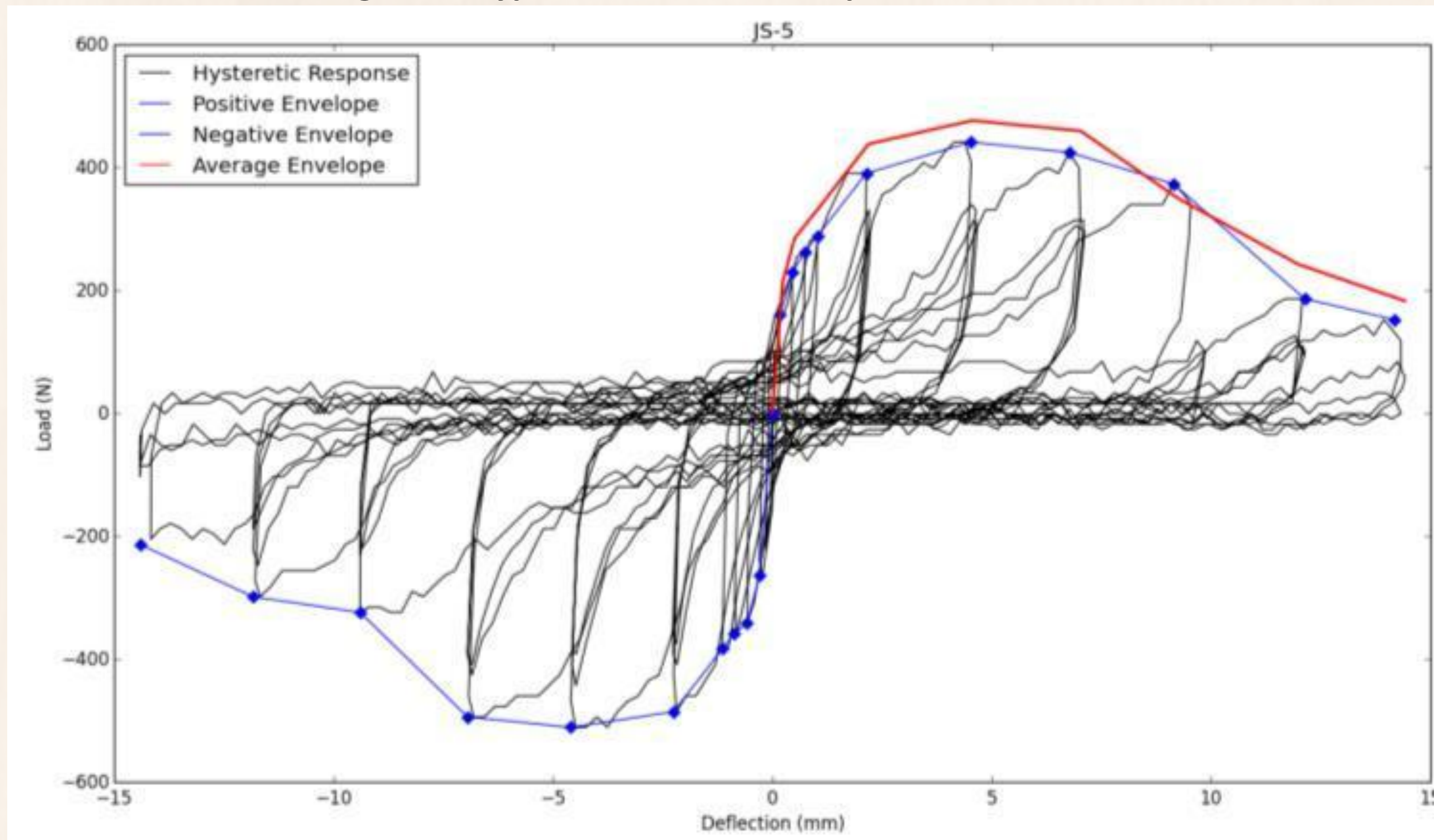
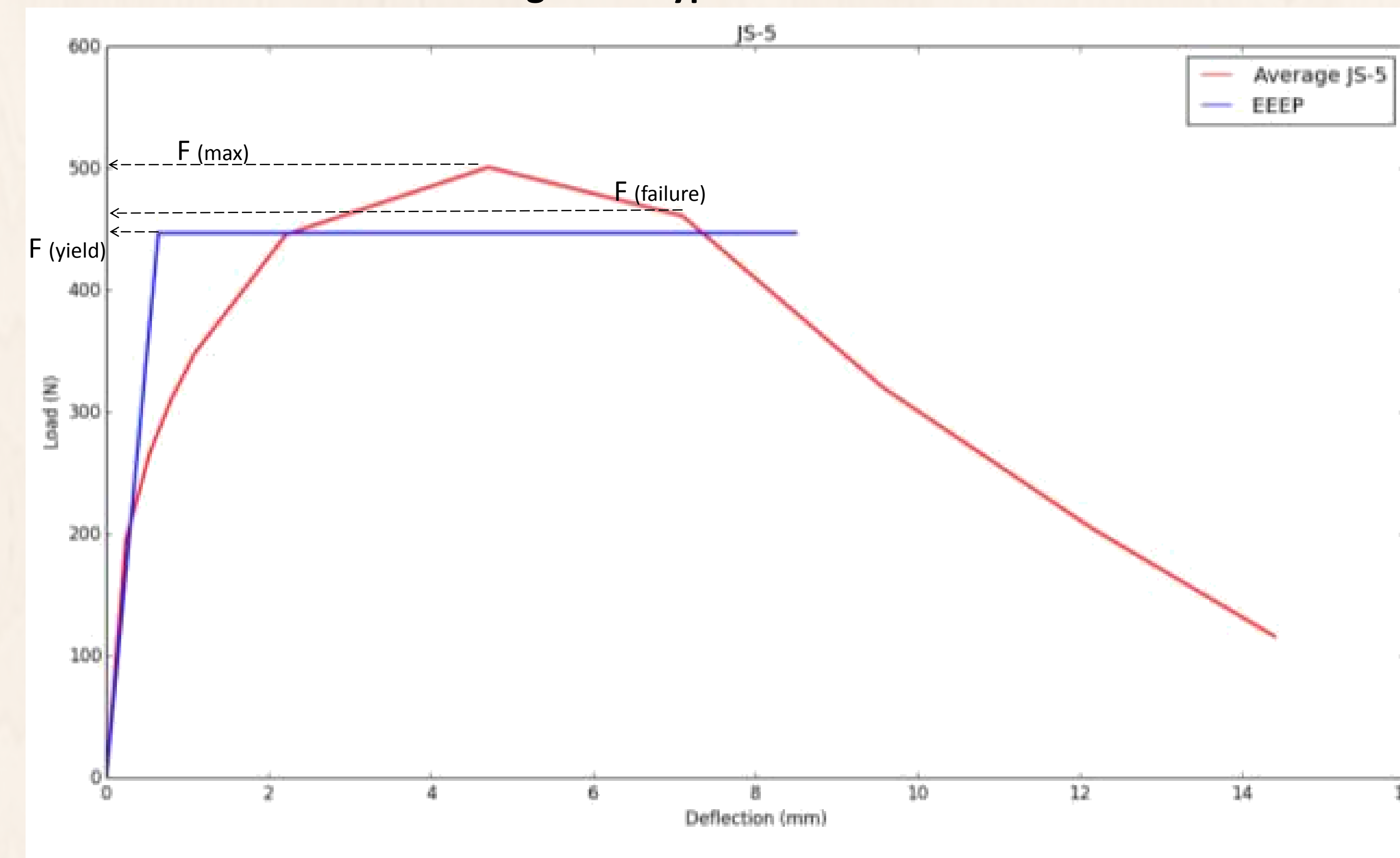
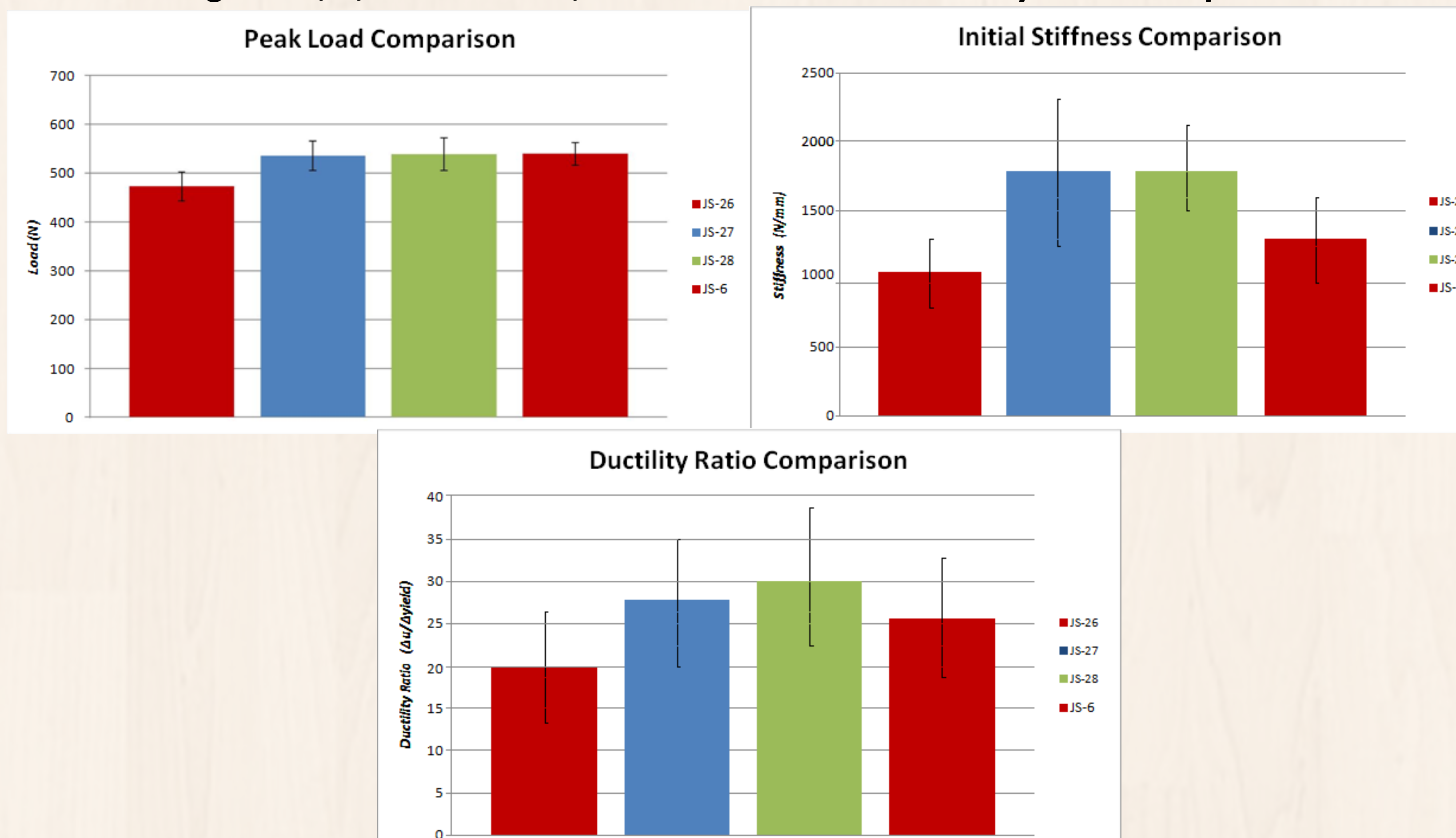


Figure 2: Typical EEEP Model



Figures 3, 4, 5: Peak Load, Initial Stiffness and Ductility Ratio Comparisons



4. Conclusions

- The plateau behaviour of the load-deflection curve shows that the joint specimens are undergoing yielding prior to fracture (ductile behaviour).
- As a result, a structure using this design will be able to resist severe earthquake shocks without direct collapse.
- This is essential since ductile behaviour gives a notice to the occupants and provides sufficient time to take preventive measures.
- In general, the results obtained for regular and type-X GWB have the same range of values. Some differences, as seen below, exist between the two red columns.

Peak Load (N)	Initial Stiffness (N/mm)	Ductility Ratio ($\Delta u/\Delta_{yield}$)
1.14	1.23	1.30

- Extended research is in progress in order to evaluate whether these two groups can be considered as one group or as two separate groups.

5. Acknowledgements

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